Prüfbericht-Nr.: *Test report no.:*	**IN24BGDW 001**	**Auftrags-Nr.:** *Order no.:*	**146961665 0010**	Seite 1 von 29 *Page 1 of 29*
Kunden-Referenz-Nr.: *Client reference no.:*	2133653	**Auftragsdatum:** *Order date:*	2024-09-12	
Auftraggeber: *Client:*	KoreLock, Inc 7100 E. Bellevue Ave. Suite 203, Greenwood Village, CO, USA, 80111			
Prüfgegenstand: *Test item:*	Smart Lock			
Bezeichnung *Identification*	PDQ series locks	**Serien -Nr.:** *Serial no.:*	Engineering Samples	
Auftrags-Inhalt: *Order content*:	Testing and issue of Test Report with Grant Certificate			
Prüfgrundlage: *Test specification:*	FCC Part 15 Subpart C 15.225,15.205, 15.207 & 15.209			
Wareneingangsdatum: *Date of sample receipt:*	2024-09-16			
Prüfmuster-Nr.: *Test sample no:*	A003819001-002 & A003819001-012			
Prüfzeitraum: *Testing period:*	2024-09-16 - 2024-09-20			
Ort der Prüfung: *Place of testing:*	Wireless laboratory, Bangalore			
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (India) Pvt. Ltd. 27/B,2nd cross road, Electronic city Phase1, Banglore-560100, India FCC Test Site Registration No: 496599			
Prüfergebnis*: *Test result*:*	Pass			

geprüft von: *tested by:*		**genehmigt von:** *authorized by:*	
Datum: *Date:* 2025-01-06		**Ausstellatum:** *Issue date:* 2025-01-07	
Stellung / *Position:*	**Likhithesh M D** **Senior Engineer**	**Stellung** / *Position:*	**Madhu K.N** **Assistant Manager**
Sonstiges / *Other:*	**FCC ID: 2AV6C-CRCM1101B1** **Contains FCC ID: 2AV6C-CRCM1101B1**		

Zustand des Prüfgegenstandes bei Anlieferung: **Prüfmuster vollständig und unbeschädigt**
Condition of the test item at delivery: ***Test item complete and undamaged***

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.
V05

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. *The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.* *Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.*
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. *The decision rule for statements of conformity in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.*

TEST SUMMARY

Test Item	FCC Clause	Result
Occupied Channel Bandwidth	-	Pass
Frequency Tolerance	FCC part 15 Subpart C Section 15.225 (e)	Pass
Field Strength Measurement within the band 13.110MHz to 14.010MHz	FCC part 15 Subpart C Section 15.225 (a, b, c, d) / (15.209)	Pass
Radiated Spurious emission	FCC 15.209/15.205	Pass

Note:
N/T → Not Tested

Smart Lock product uses certified RF modules with **FCC ID: 2AV6C-CRCM1101B1**,Hence the above mentioned test cases are excluded and which can be found in the module test report of respective FCC ID

Product	Applicant	FCC ID	Report No	Issued By	Grant Date
NFC 13.56MHz	PassiveBolt, Inc.	2AV6C-CRCM1101B1	PBCRCM-WR2422TXB	Amber Helm Development L.C.	2024.04.12

Product Category: Electronics Testing

Test Discipline: EMC Test Facility

REVISION HISTORY OF THIS REPORT

Report Number	Version	Description	Issue date
IN24BGDW 001	01	Initial issue of report	2025-01-07

Note:
Smart Lock product having different models & all models are identical hence we tested **PDQ Series.**

Smart Lock Product list.

SL No.	Product Name	Model No	Lock Dimensions L x W x H (cm)	Variants
1	Smart Lock	KMS	13cm x 10cm x 14cm	Keypad Lock Without Keypad Lock
2		GTS	22cm x 20cm x 24cm	
3		6EWS	16cm x 18cm x 32cm	
4		MRS	20cm x 18cm x 34cm	
5		CLS	20cm x 17cm x 32cm	
6		SDS	16cm x 16cm x 15cm	

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1 GENERAL REMARKS

1.1 Attachments

All attachments are part of this test report and are issued in separate document.

1. Test Setup Photos
2. EUT External Photos
3. EUT Internal Photos

2 TEST SITES

2.1 Testing Facilities

1. TÜV Rheinland (India) Pvt.Ltd.,
   27/B, 2nd Cross,
   ElectronicCityPhase1
   Bangalore – 560 100,
   India

   Radiated Measurement site type:
   Fully anechoic chamber (used for above 1 GHz measurements)

2. TUV Rheinland (India) Pvt.Ltd.,
   108, Beside ISBR Business School,
   Electronic city Phase I
   Bangalore - 560 100.
   India

   Radiated Measurement site type:
   Semi anechoic chamber (used for below 1 GHz measurements)

2.2 List of Test and Measurement Instruments

Table 1: List of test and measurement instruments

Equipment	Manufacturer	Model Name	Serial Number	Firmware Versions	Calibration Due Date	Periodicity	Test Facility
EMI Receiver	Rohde & Schwarz	ESW 44	101732	4.73 SP5	26.01.2025	Yearly	Radiated Spurious Emission
Loop Antenna	Frankonia	LAX-10	LAX-10-800	-	23.03.2025	Yearly	
Baloon and Biconical Antenna	Schwarzbeck mess-elektronik	VHBB-9124 / BBA-9106	01028	-	08.02.2025	Yearly	
Log-Periodic Antenna	Schwarzbeck mess-elektronik	VUSLP-9111B	9111B-111	-	03.02.2025	Yearly	
Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-1944	-	28.10.2024	Yearly	
EMI Test Receiver	Rohde & Schwarz	ESW44	101773	1.72.SP1	26.01.2025	Yearly	
Semi Anechoic Chamber	Frankonia	-	-	-	-	-	
Fully Anechoic Chamber	Albatross	-	-	-	-	-	
Signal Analyzer	Rohde & Schwarz	FSV7	101644	3.30 SP1	09.02.2025	Yearly	Conducted Test Parameters TS8997 System

Table 2: Instrument application Software versions

SL. No.	Test Type	Application software	Version
1	Radiated spurious emission measurement in FAC	EMC 32	10.60.20
2	Radiated spurious emission measurement in 10mtr SAC	BAT EMC	3.20.0.17

3 GENERAL PRODUCT INFORMATION

3.1 Product Function and Intended Use

KoreLock, Inc. is an IoT technology company that provides turnkey embedded and app solutions that enable lock manufacturers and access control providers to build and sell connected locking devices. KoreLock's Smart Lock solutions are embedded in over 50,000 locking devices worldwide. KoreLock customers include lock manufacturers and access control software companies that would rather utilize a proven smart lock platform than the risk and expense of building on their own.

3.2 Ratings and System Details of Equipment under Test

Table 3: Ratings and System Details as declared by Client*

Radio Protocol	NFC
Operating Frequency Range	13.110 – 14.010 MHz
No. of Channels	Single Frequency (13.56MHz)
Measured transmitted Field Strength(dBµV/m)	38.40 dBµV/m PDQ 6EWS without keypad 37.30 dBµV/m PDQ 6EWS with keypad
Modulation	ASK
Number of antennas	1
Antenna Gain	Integral
Antenna Type	PCB Loop Antenna
Supply Voltage to Product	6VDC (4* 1.5V of AA Batteries)
Environmental conditions	Operating Temp: -40°C to +66°C
	Storage Temp: -40°C to +66°C
EUT Dimension(L x W x H) in inches	4.5 x 4.5 x 1.00 in Cm

***Disclaimer**: The information/data is supplied by the client and the same is considered to arrive at the final value. Any changes made apart from the specified specification, can directly impact on the tests results. Refer the products user manual for more details.

3.3 Measurement Uncertainty:

Reported uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of *k* = 2

Table 4: Measurement Uncertainty

Parameter	Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3 dB
Unwanted Emissions, conducted	±3 dB
All emissions, radiated	±6 dB
Temperature	±3 ℃
Supply Voltages	±3 %
Time	±5 %

4 TEST SET-UP AND OPERATION MODE

4.1 Principle of Configuration Selection

Transmission was enabled with highest possible duty cycle transmission on low, mid and high channel.

4.2 Test Operation and Test Software

Hardware Version: A110

Hardware Name: PBCRCM1101

Software Version: Production

Software Name: PDQ App

4.3 Special Accessories and Auxiliary Equipment

- None

4.4 Countermeasures to achieve EMC Compliance

- None

4.5 TUV Sample Identification

1. TUV Sample Identification number: A003819001-002– Radiated test Sample
   A003819001-012-- Conducted test Sample

5 Operational Description

Kore Lock's printed circuit boards provide WiFi connectivity to the cloud, BLE communication with mobile apps, and full-featured access control functionality. Kore Lock's patented WiFi technology allows users to control their lock from anywhere in the world. When in range, control the lock in real time over BLE. PDQ lock embedded firmware provides full-feature access control, including NFC & RFID access control for lock-unlock activity, including credentials, lock settings, schedules, and event history.

6 TEST METHODOLOGY

6.1 Radiated Emission Test

The radiated emission measurement was performed according to the procedures in ANSI C63.10-2013. The equipment under test (EUT) was placed at the middle of the 80 cm high turntable for below 1 GHz & 1.5 m height for above 1 GHz measurement, and the EUT is 3 meters far from the measuring antenna. The turntable was rotated 360° for obtaining the maximum emission. The height of the measuring antennas was scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations. Repeat the measurement steps until the maximum emissions were obtained. The measurement above 1000 MHz was performed by horn antenna, The measurement below 30 MHz was performed by loop antenna, Measurement from 30 MHz to 200 MHz was performed by Balloon and Biconical Antenna, and measurement from 200 MHz to 1 GHz was performed by Log-Periodic Antenna.

The EUT was rotated around the X-, Y-, and Z-Axis and the results from worst case axis are recorded

6.1.1 Test Setup Configuration

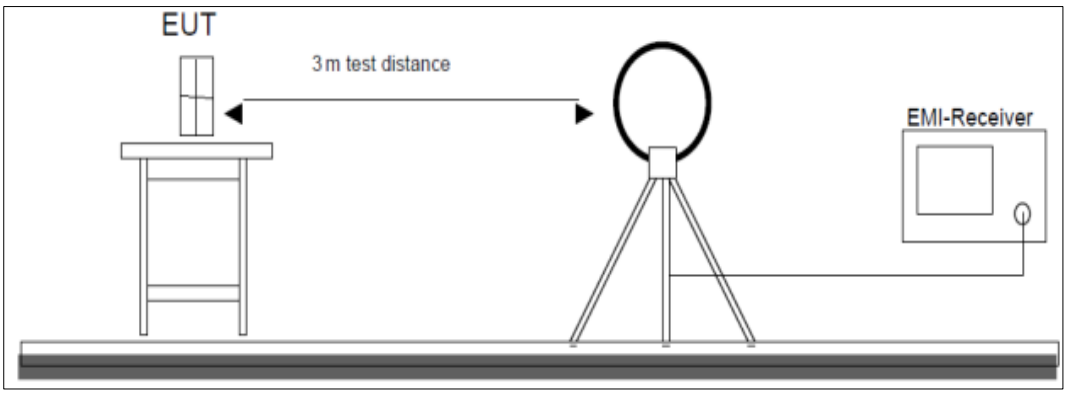


Figure 1: Frequency Range 9 kHz- 30 MHz

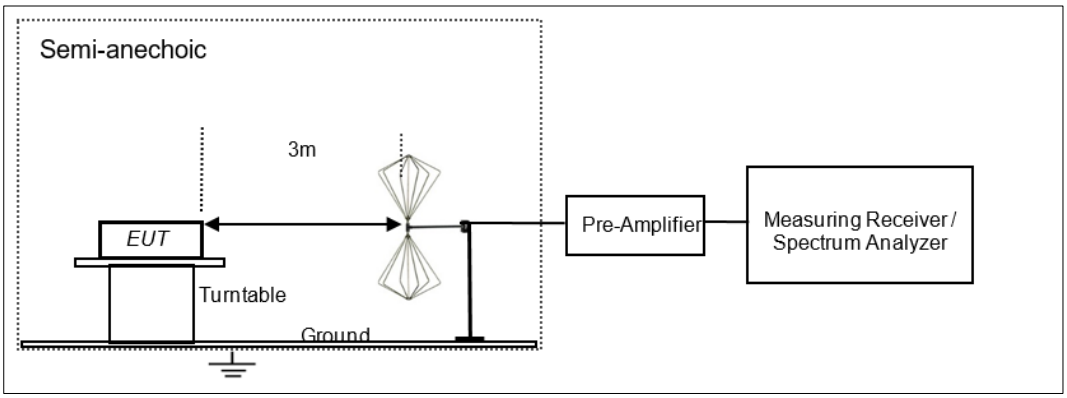


Figure 2: Frequency Range 30 MHz – 200 MHz

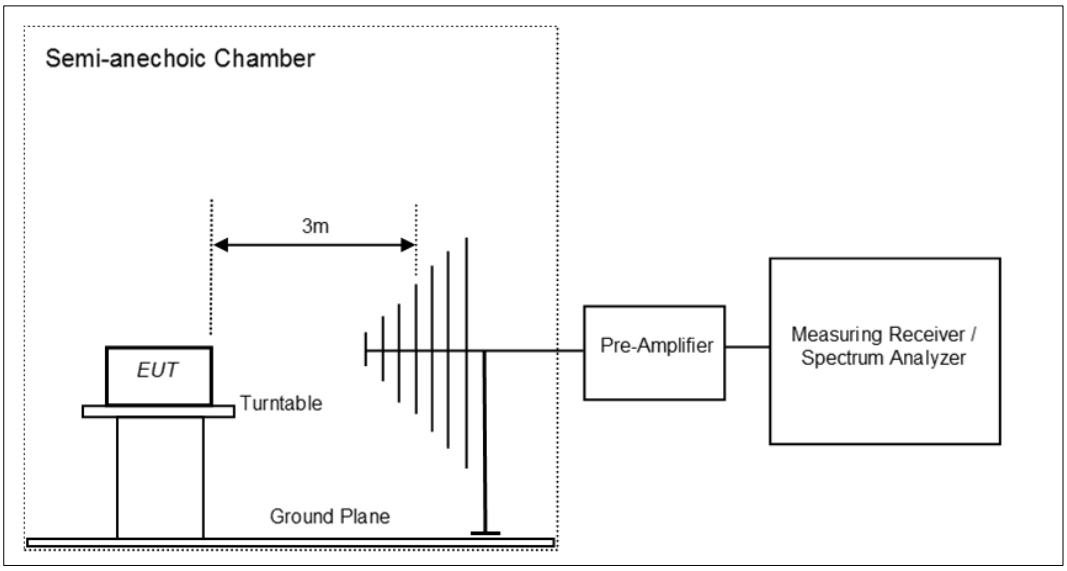


Figure 3: Frequency Range 200 MHz - 1GHz

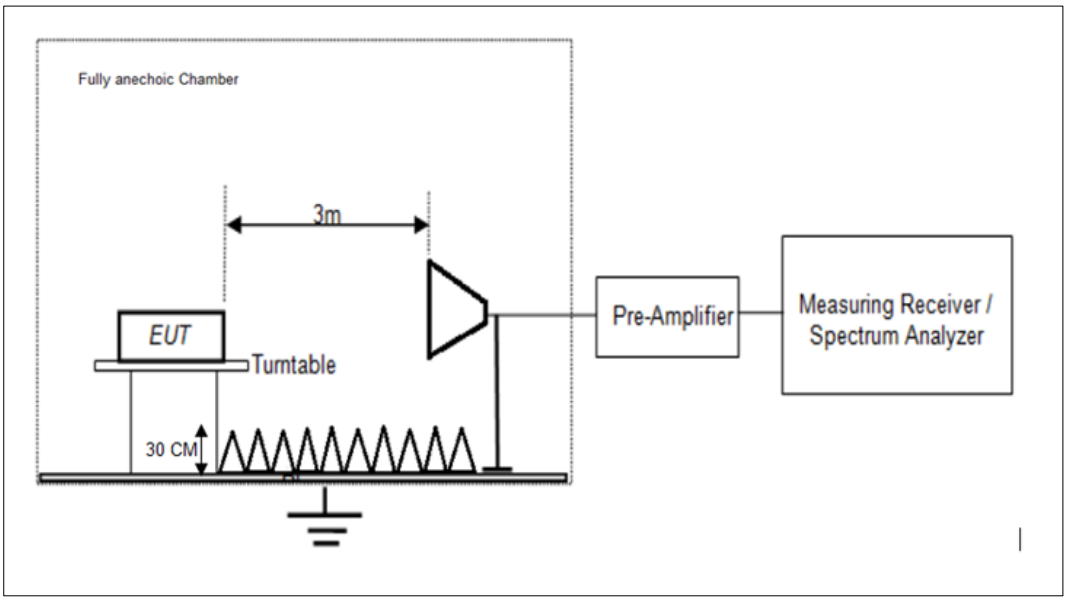


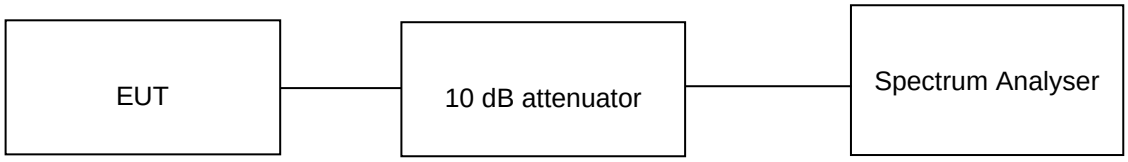
Figure 4: Frequency Range above 1 GHz

7 TEST RESULTS

7.1 Occupied Channel Bandwidth & 20dB Bandwidth

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.215
Test Method	Subclause 6.9.3 of ANSI C63.10
Measurement Bandwidth	300Hz
Detector	Peak
Port of testing	Antenna port
Requirement	Operation of the EUT must be within the assigned frequency band i.e., 13.553MHz to 13.567MHz



Test Condition

Normal Test Condition:

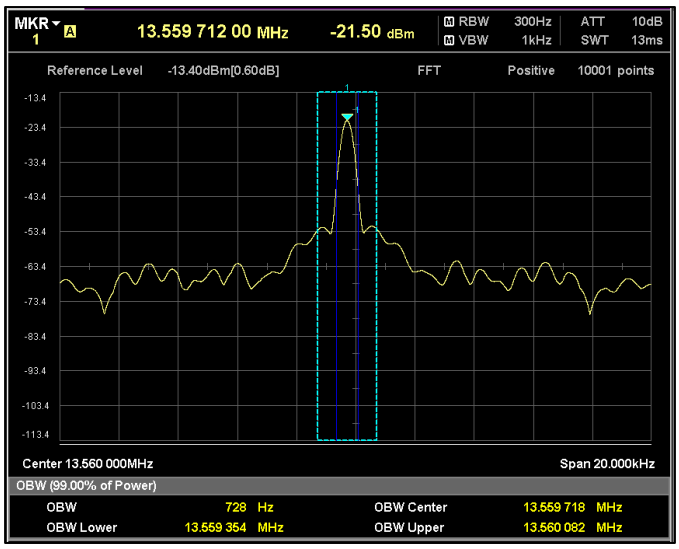
Temperature (Norm) = + 22°C Voltage = 6VDC through AA Batteries(1.5V*4) Relative humidity: 62 %

Test results:

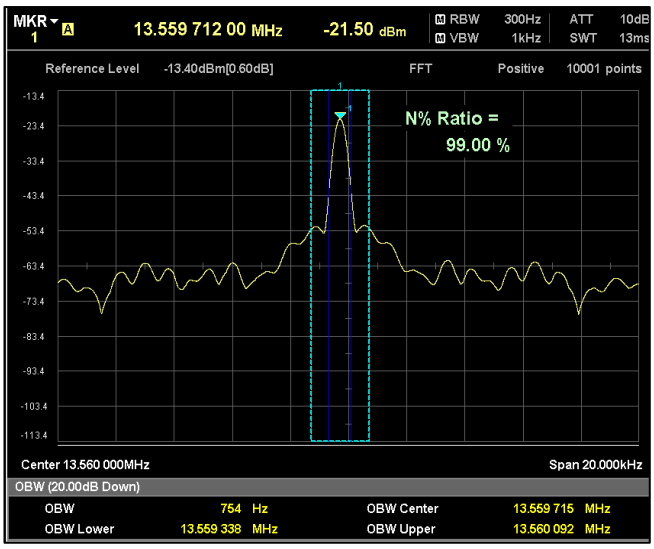
Note: All the losses are included during measurement and final values are mentioned in the test report

Channel Frequency (MHz)	Measured 99% Occupied Channel Bandwidth (MHz)	Measured 20dB Bandwidth (MHz)	Limit (MHz)
13.56	0.000728	0.000754	Operation of the EUT must be within the assigned frequency band i.e. 13.553MHz to 13.567MHz

Test Plots:



99% Bandwidth



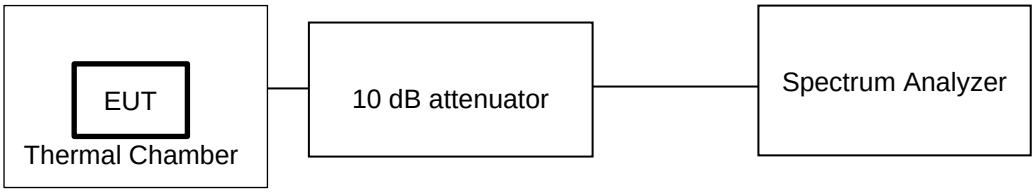
20dB Bandwidth

7.2 Frequency Tolerance

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.225(e)
Test Method	Subclause 6.8 of ANSI C63.10
Measurement Bandwidth	30Hz
Detector	Peak Detector
Requirement	The frequency tolerance of the carrier signal shall be maintained within ±0.01% as per FCC

Test Method:



Test Condition

Normal Test Condition:

Temperature (Norm) = + 22°C Voltage = 6VDC through AA Batteries(1.5V*4) Relative humidity: 62 %

Extreme Temperature:

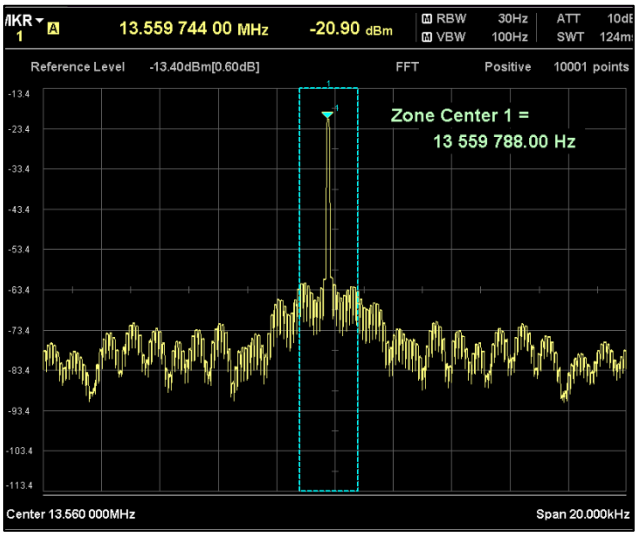
Nominal temperature: 15 °C to 30 °C

Extreme temperatures : -20 °C to + 60 °C with temperature variation step of 10°C

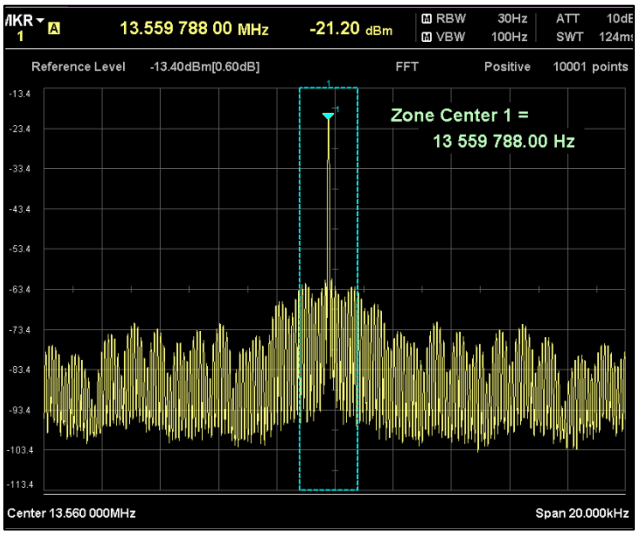
Table 5: Test Results of frequency tolerance

Channel Frequency (MHz)	Temperature variation (°C)	Voltage variation (VDC)	Measured Frequency (MHz)	Frequency Deviation (Hz)	Frequency Deviation Limit (Hz)
13.560000	-35	6	13.560510	0.000510	±1356
13.560000	-25		13.560510	0.000510	±1356
13.560000	-15		13.560510	0.000510	±1356
13.560000	-5		13.560510	0.000510	±1356
13.560000	5		13.560510	0.000510	±1356
13.560000	15		13.560430	0.000430	±1356
13.560000	25		13.560410	0.000410	±1356
13.560000	35		13.560410	0.000410	±1356
13.560000	45		13.560410	0.000410	±1356
13.560000	55		13.560410	0.000410	±1356
13.560000	65		13.560410	0.000410	±1356
13.560000	Normal	+15%	13.560442	0.000442	±1356
13.560000		-15%	13.560448	0.000448	±1356

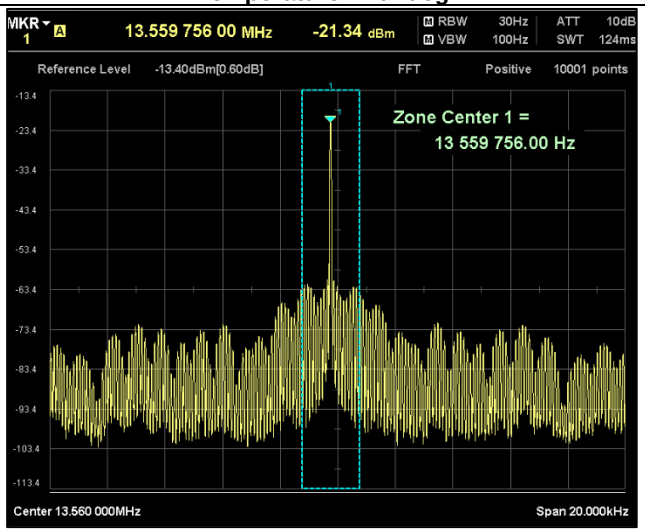
Test Plots:



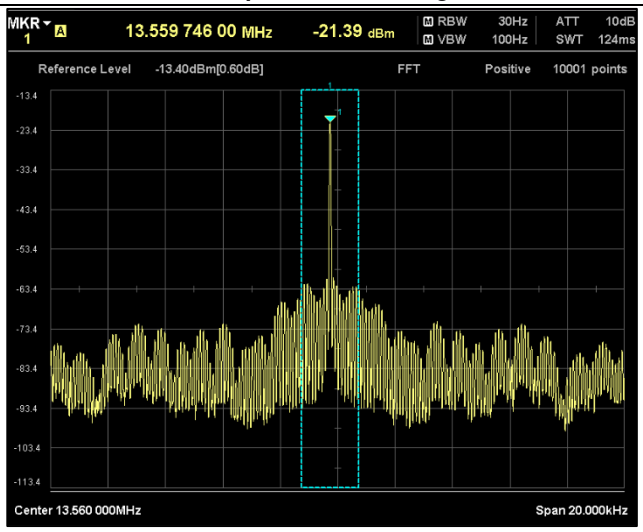
Temperature: -40° deg



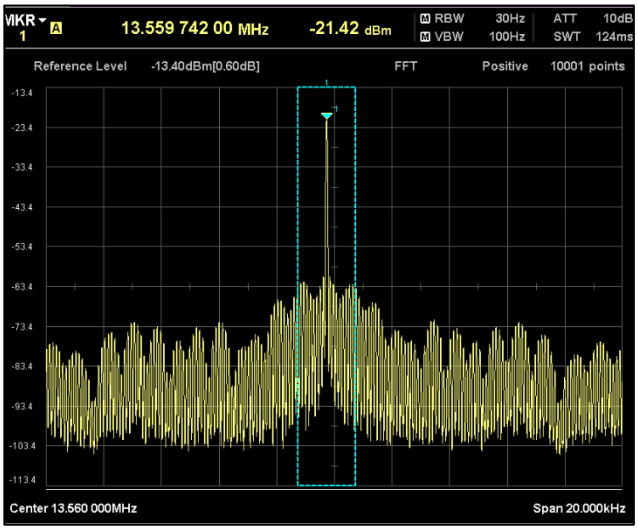
Temperature: -30° deg



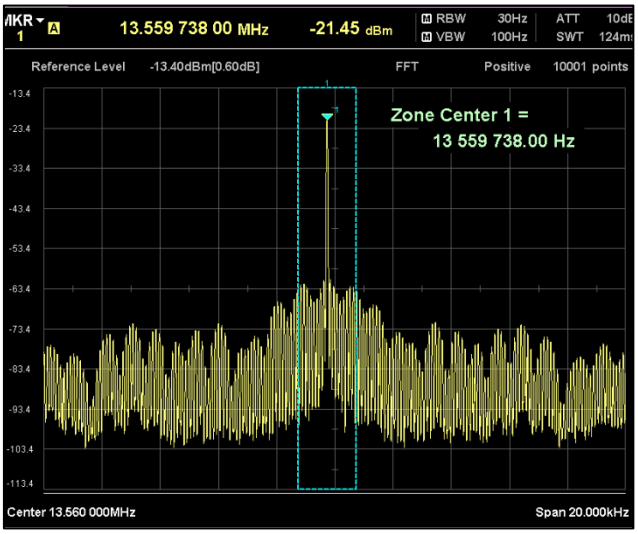
Temperature: -20° deg



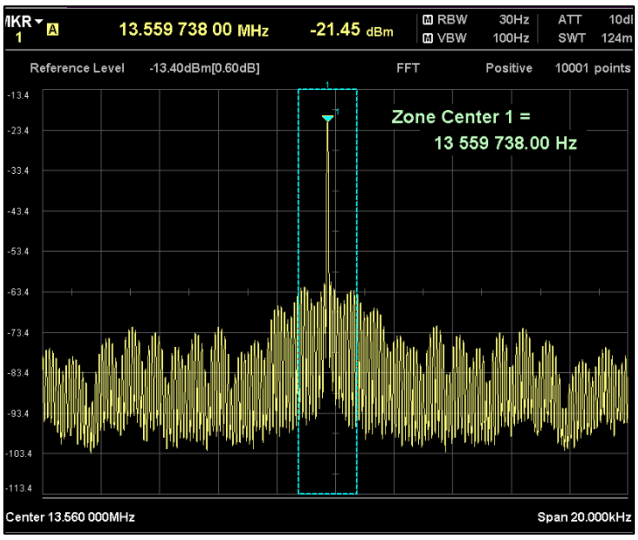
Temperature: -10° deg



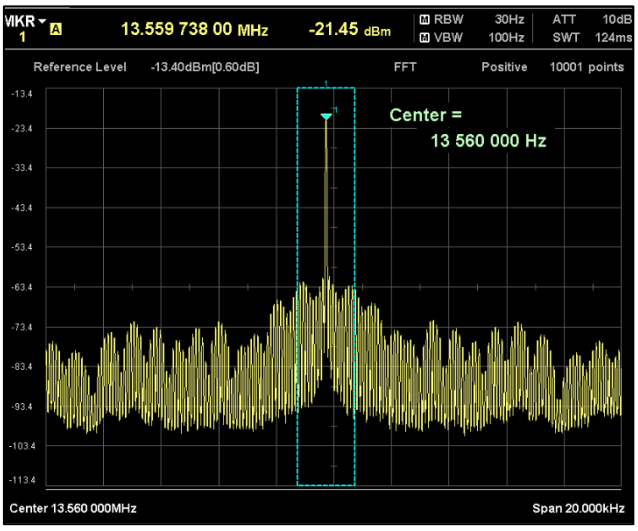
Temperature: 0° deg



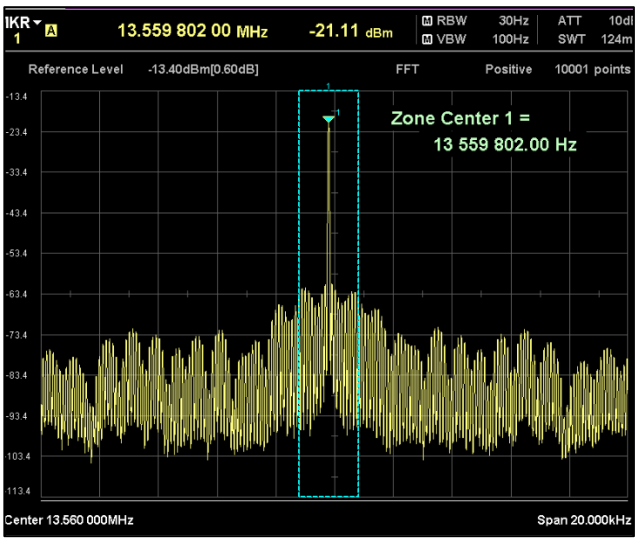
Temperature: +10° deg



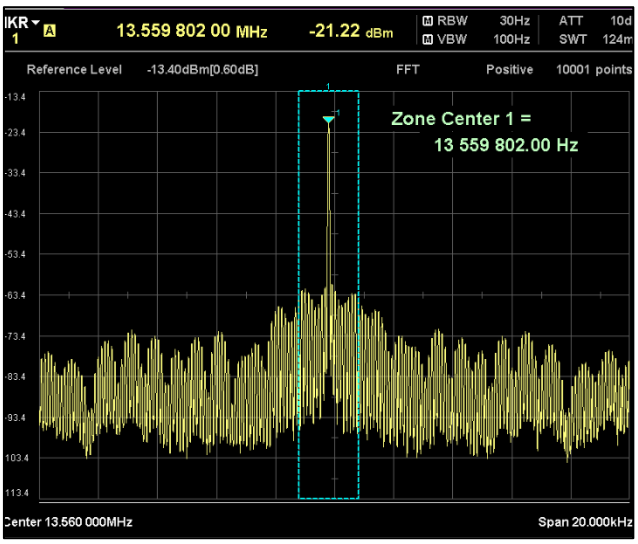
Temperature: +20° deg



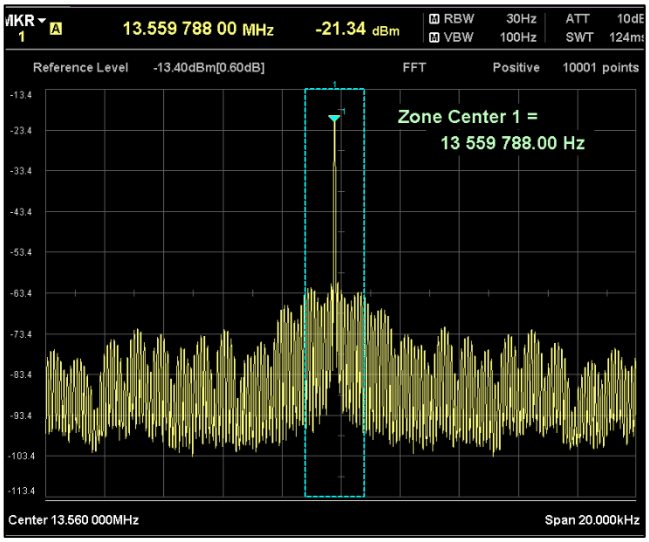
Temperature: +25° deg



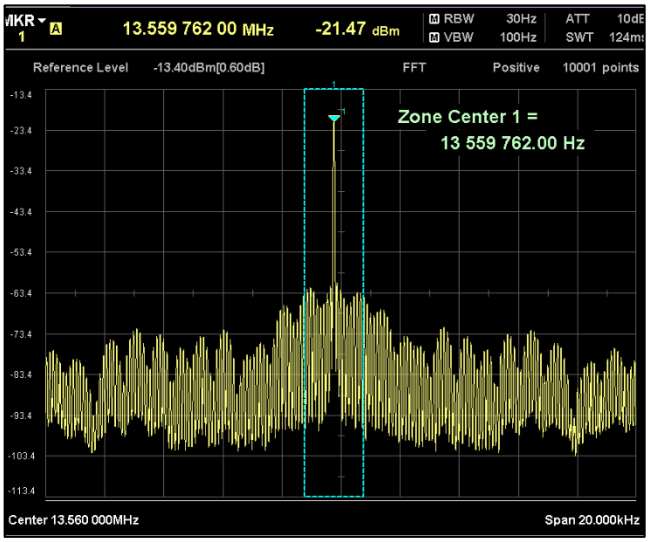
Temperature: +30° deg



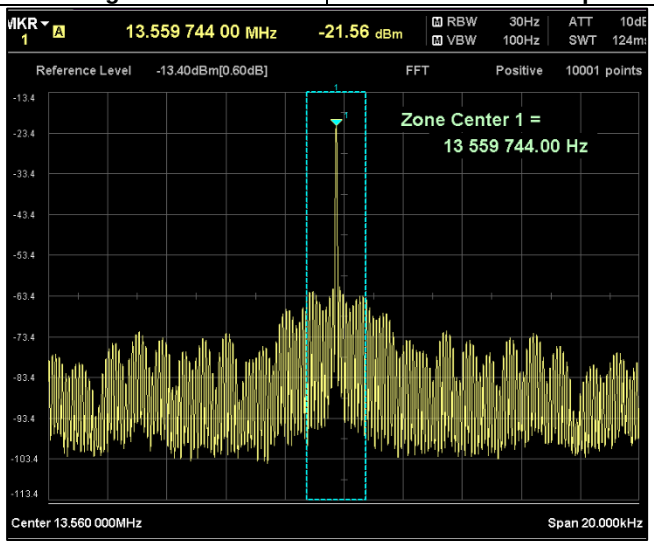
Temperature: +40° deg



Temperature: +50° deg

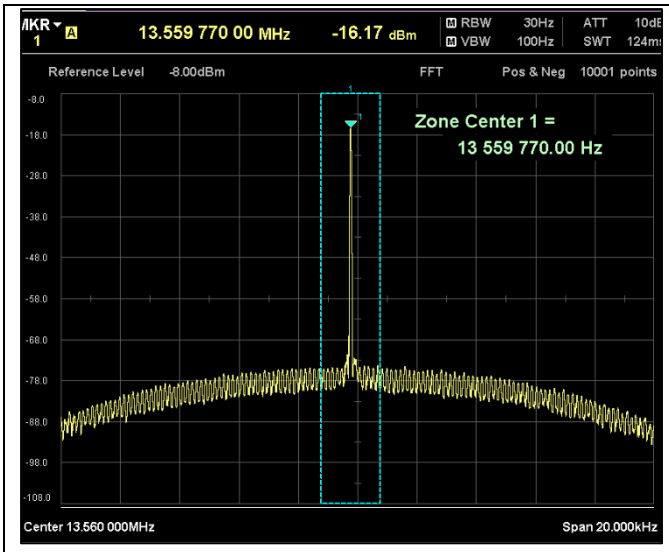


Temperature: +60° deg

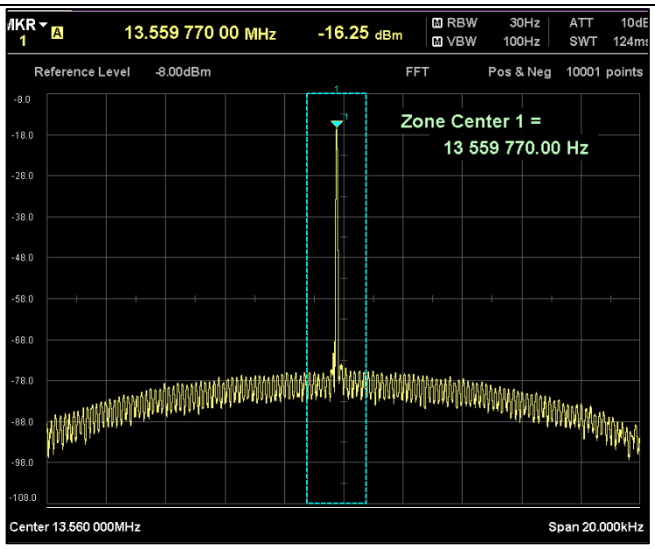


Temperature: +66° deg

Test Plots for Voltage variation:



Nominal Temp with voltage of 5.1VDC



Nominal Temp with voltage of 6.9VDC

7.3 Field Strength Measurement Within the Band 13.110MHz to 14.010MHz

Result ***Pass***

Test Specification	FCC part 15 Subpart C Section 15.225 (a, b, c, d)
Test Method	ANSI C 63.10 – 2013
Measurement Location	Semi Anechoic Chamber
Measuring Distance	3 m
Detector	Peak detector
Requirement	As mentioned in the below Table 6
Test setup	Refer TEST METHODOLOGY

Table 6: Field strength limits in 13.110-14.010 MHz operation

Frequency (MHz)	Field strength (µV/m)	Field strength limit for 30-meter distance (dBµV/m)	Field strength limit for 3-meter distance (dBµV/m)
13.553 -13.567	15848	83.99	123.99
13.410-13.553 and 13.567 -13.710	334	50.47	90.47
13.110 -13.410 and 13.710-14.010	106	40.5	80.5

Note: As per the 15.31 Section f(2) , distance correction factor of 40dB/decade is used to convert Field strength limit from 30-meter to 3-meter measurement antenna distance

Test Condition

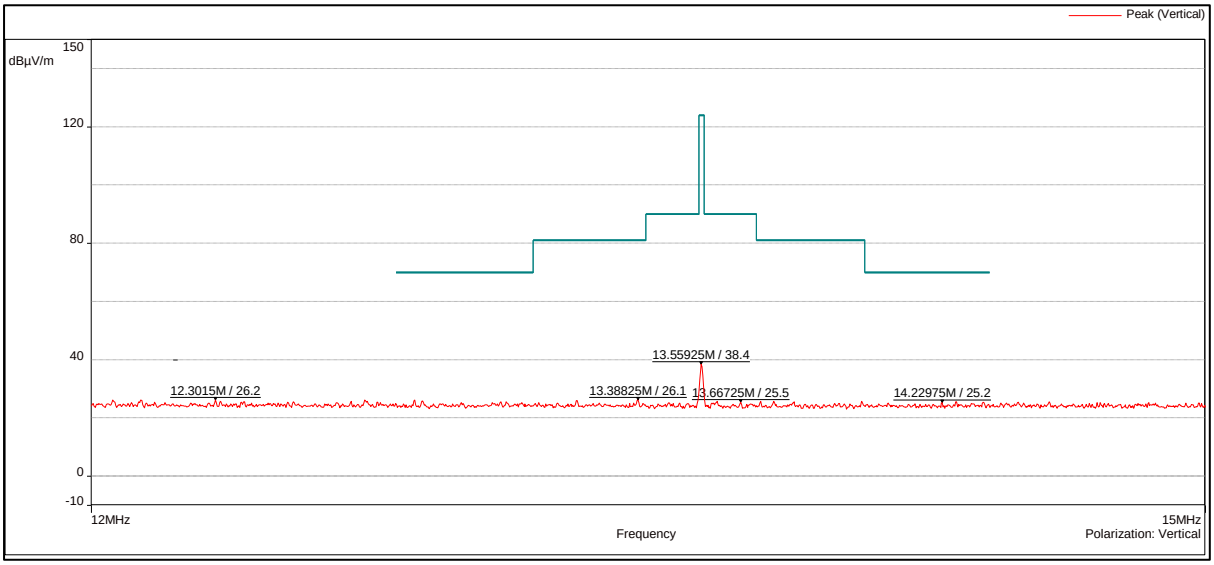
Normal Test Condition:

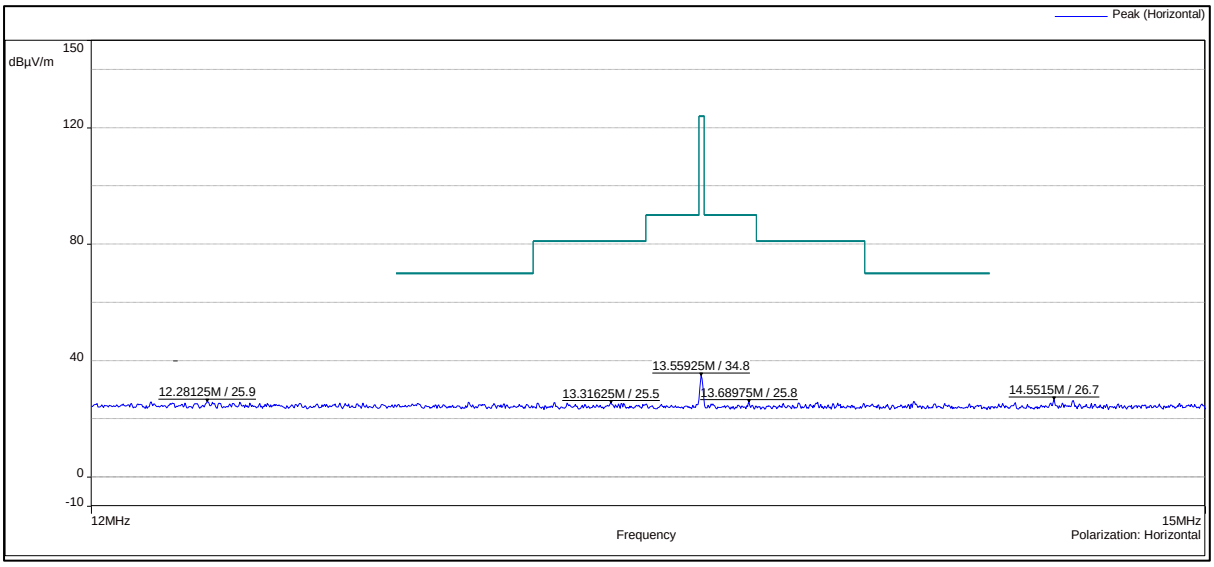
Temperature (Norm) = + 22°C Voltage = 6VDC through AA Batteries(1.5V*4) Relative humidity: 62 %

Test Results of PDQ 6EWS without keypad:

Antenna Polarization	Frequency range (MHz)	Measured Frequency (MHz)	Field Strength (dBµV//m)	Limit (dBµV//m)	Margin (dB)
Parallel	13.11-13.41	13.38	26.10	80.50	-54.40
	13.41-13.553	13.55	38.40	90.47	-52.07
	13.567-13.71	13.66	25.50	90.47	-64.97
	13.71-14.01	13.77	25.20	80.50	-55.30
Perpendicular	13.11-13.41	13.31	25.50	80.50	-55.00
	13.41-13.553	13.55	34.80	90.47	-55.67
	13.553-13.567	13.68	25.80	90.47	-64.67

Test Plots:

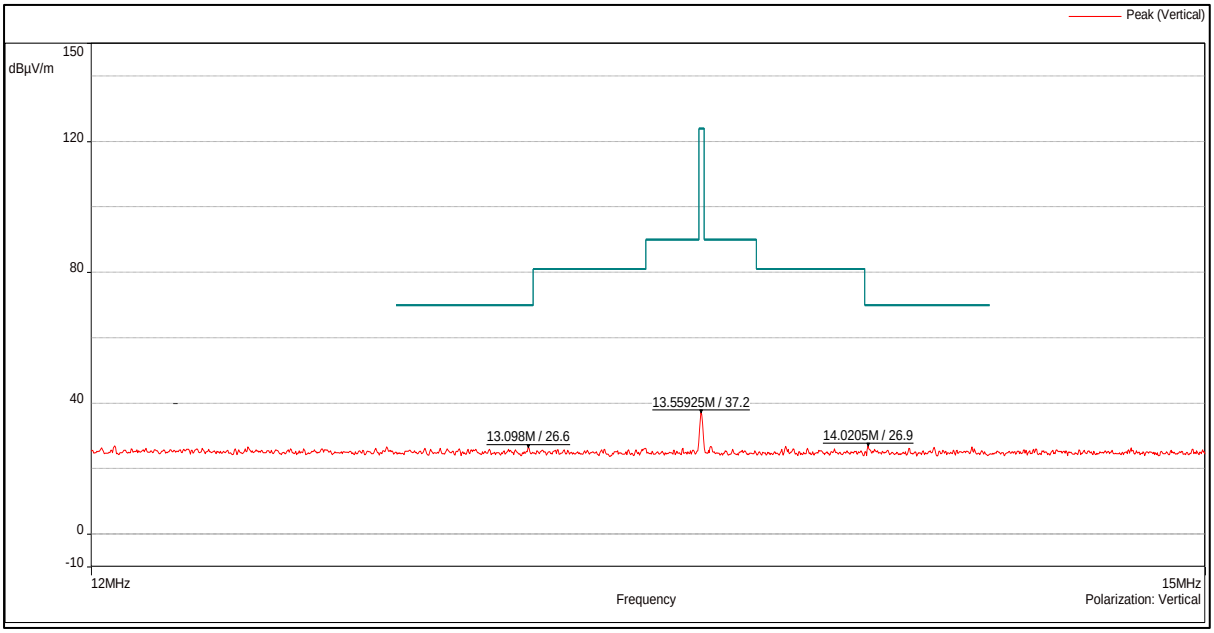


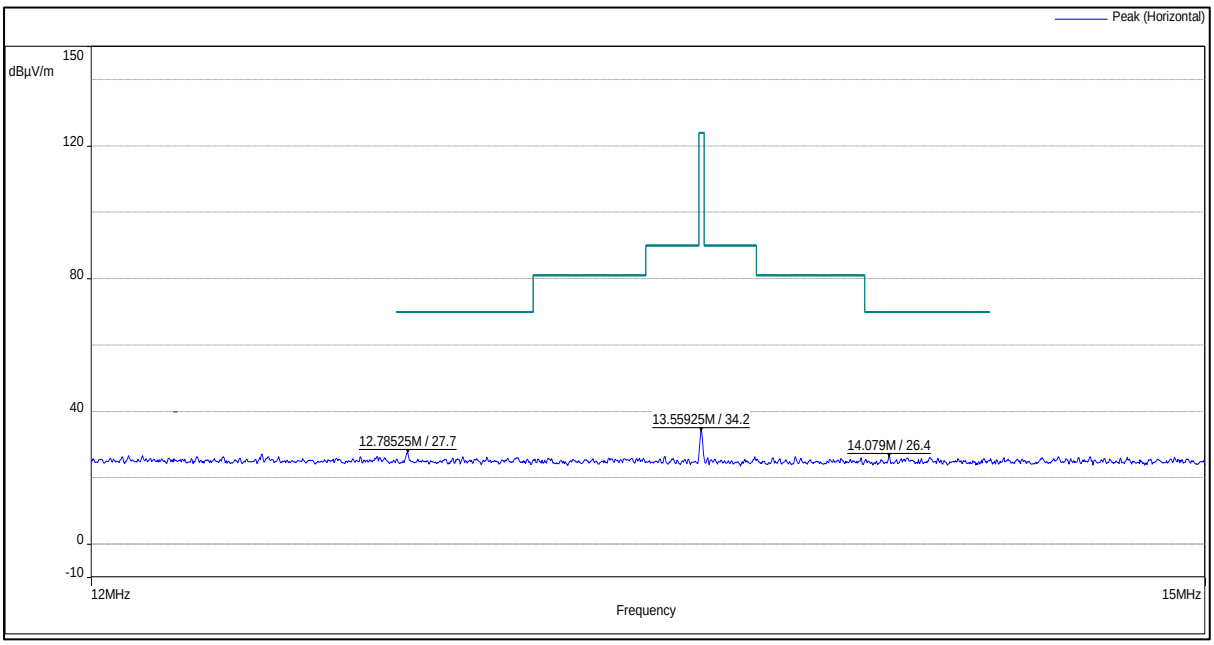


Test Results of PDQ 6EWS with keypad:

Antenna Polarization	Frequency range (MHz)	Measured Frequency (MHz)	Field Strength (dBµV//m)	Limit (dBµV//m)	Margin (dB)
Parallel	13.11-13.41	13.09	26.60	80.50	-53.90
	13.41-13.553	13.55	37.20	90.47	-53.27
	13.41-13.553	13.55	34.20	90.47	-56.27

Test Plots:





7.4 Radiated Spurious Emission

Result ***Pass***

Test Specification	FCC part 15 Subpart C 15.247 (d) / (15.209 & 15.205)
Test Method	ANSI C63.10
Measurement Location	Semi anechoic chamber
Measurement Bandwidth	100 kHz for frequency range < 1GHz
Detector	Refer remarks below
Measuring Distance	3 m
Requirement	As per the limits mentioned in the below table
Test setup	Refer TEST METHODOLOGY

Table 7: Transmitter limits for Radiated emission

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Distance of Measurement (m)
0.009 – 0.490	2400/F(kHz)	48.50 – 13.80	300*
0.490 – 1.705	24000/F(kHz)	33.80 – 23.00	30*
1.705 -30	30	29.54	30*
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Remark: * The limit shows in the table above of frequency range 0.009 – 0.490, 0.490 – 1.705 MHz and 1.705-30MHz is at 300-meter, 30 meter and 30-meter range respectively, which corresponds to 128.51 – 93.80, 73.80 – 62.96 and 69.54 dBµV/m at 3m range by extrapolation calculation and the measurement of loop antenna.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

Test Conditions:

Temperature (Norm) = + 22°C Voltage = 6VDC through AA Batteries(1.5V*4) Relative humidity: 62 %

Test results:

Note: All the losses are included during measurement and final values are mentioned in the test report. Refer TEST METHODOLOGY for more details.

Test results for frequency range 9 kHz – 30 MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported

PDQ 6EWS W/O keypad

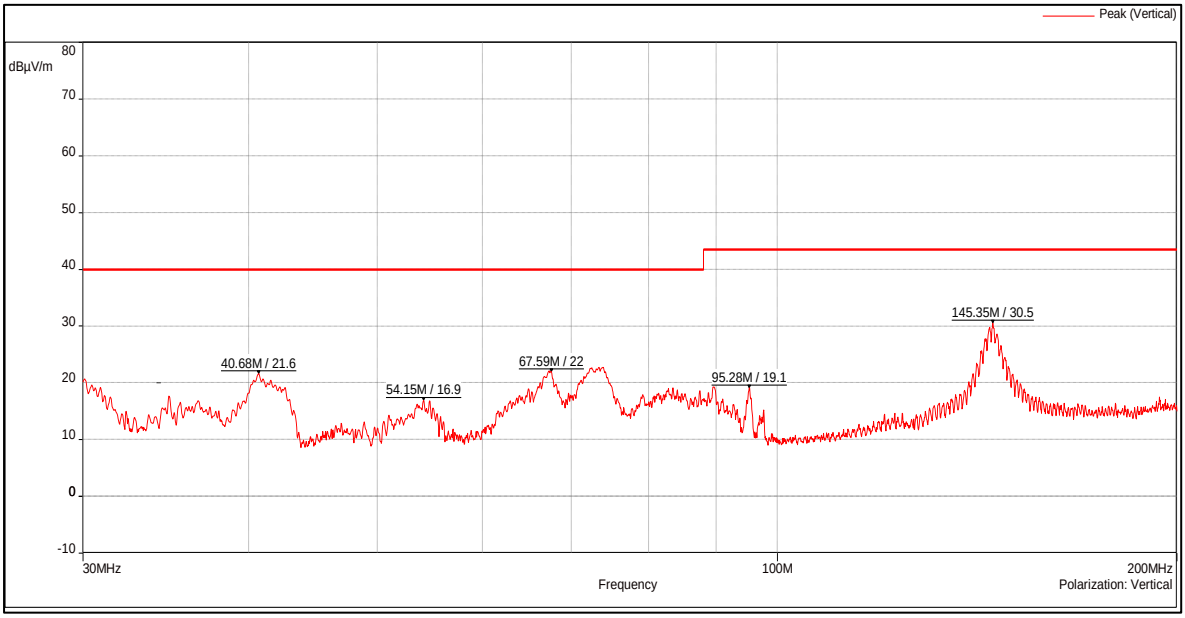
Test results for frequency range 9kHz – 30MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 8: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	40.68	21.60	40.00	-18.40
	54.15	16.90	40.00	-23.10
	67.59	22.00	40.00	-18.00
	95.28	19.10	43.50	-24.40
	145.35	30.50	43.50	-13.00
Horizontal	36.69	34.90	40.00	-5.10
	50.97	27.80	40.00	-12.20
	58.71	24.70	40.00	-15.30
	75.18	20.60	40.00	-19.40
	117.6	16.80	43.50	-26.70
	145.35	34.30	43.50	-9.20

Test Plots:



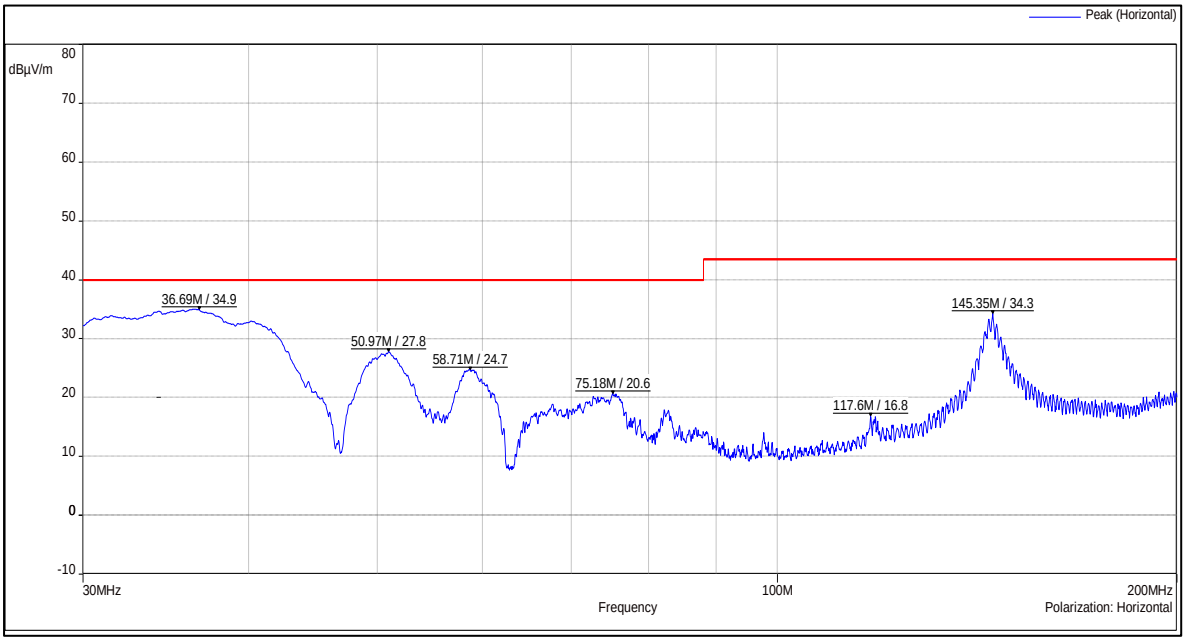
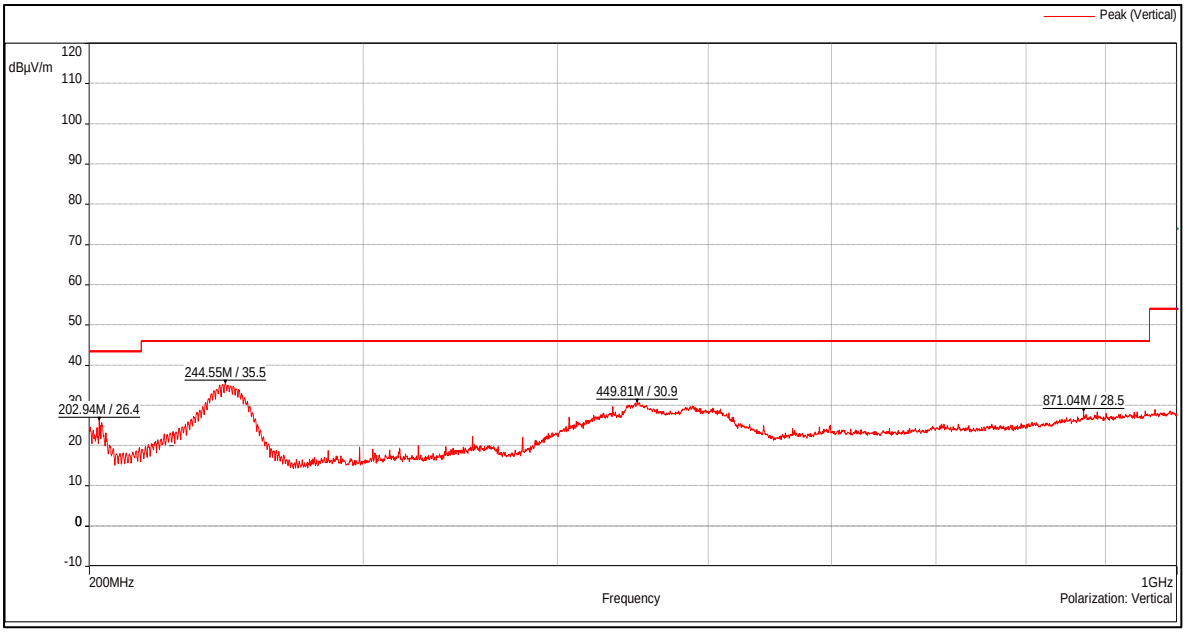
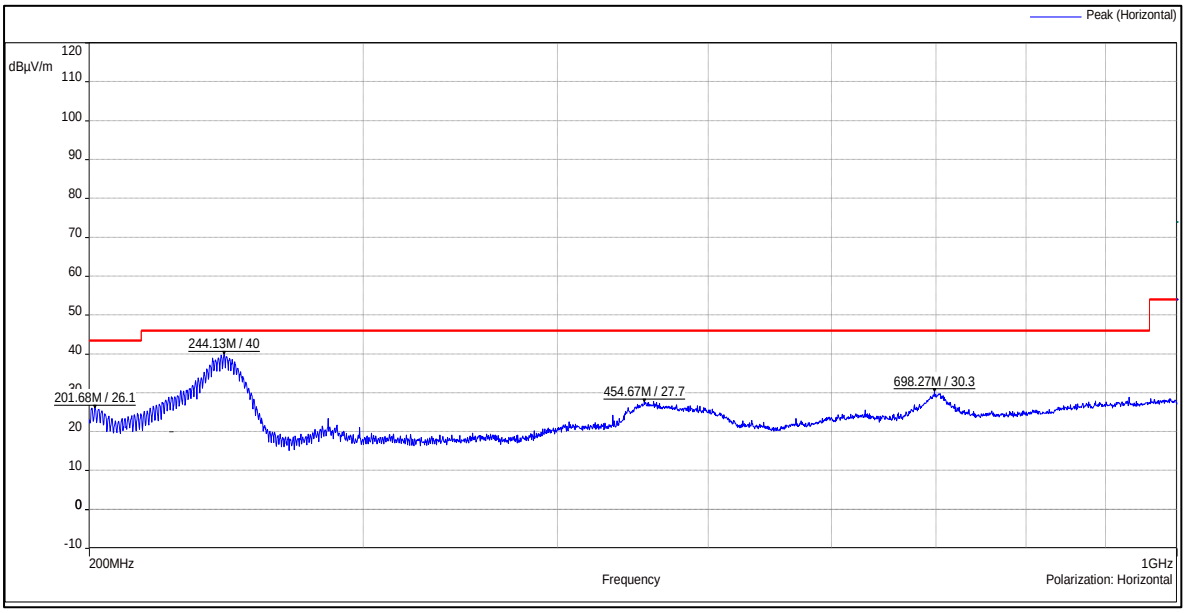


Table 9: Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	202.94	26.40	43.50	-17.10
	244.55	35.50	46.00	-10.50
	449.81	30.90	46.00	-15.10
	871.04	28.50	46.00	-17.50
Horizontal	201.68	26.10	43.50	-17.40
	244.13	40.00	46.00	-6.00
	454.67	27.70	46.00	-18.30
	698.27	30.30	46.00	-15.70

Test Plots:





PDQ 6EWS With keypad

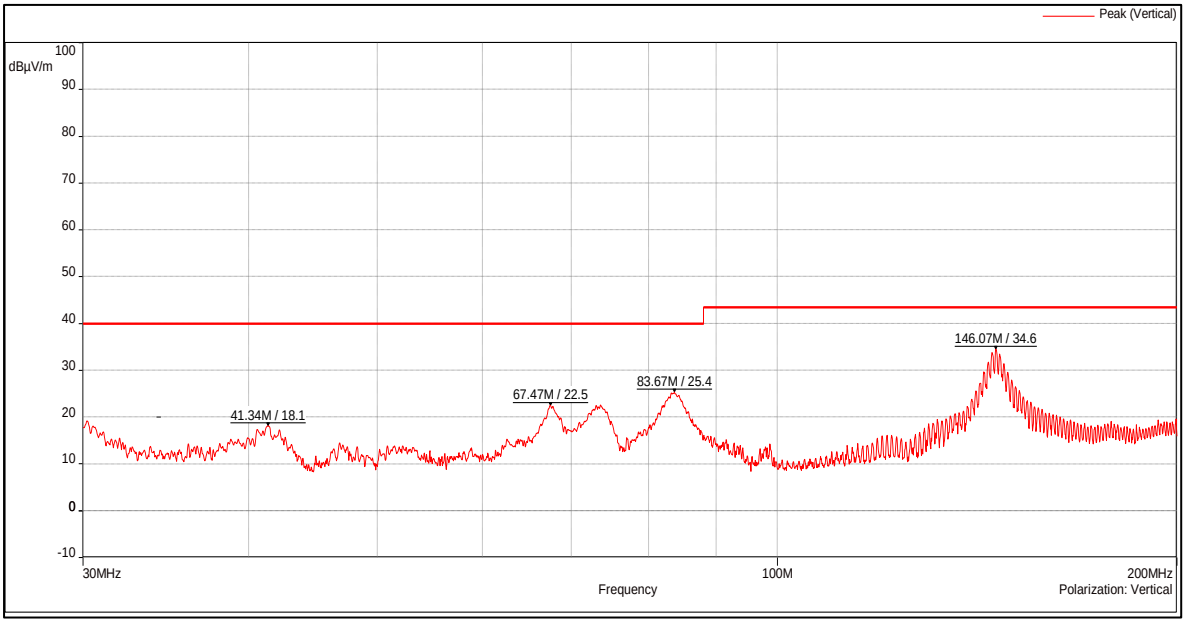
Test results for frequency range 9 kHz – 30 MHz

No emissions found in frequency range 9 kHz to 30 MHz, and measured levels are below 20dB from the limit line, hence not reported.

Table 10: Test results for frequency range 30MHz – 200MHz

Antenna Polarization	Measured Frequency (MHz)	Measured emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	41.34	18.10	40.00	-21.90
	67.47	22.50	40.00	-17.50
	83.67	25.40	40.00	-14.60
	146.07	34.60	43.50	-8.90
Horizontal	51.18	16.70	40.00	-23.30
	77.64	23.90	40.00	-16.10
	144.33	21.80	43.50	-21.70
	157.17	28.40	43.50	-15.10

Test Plots:



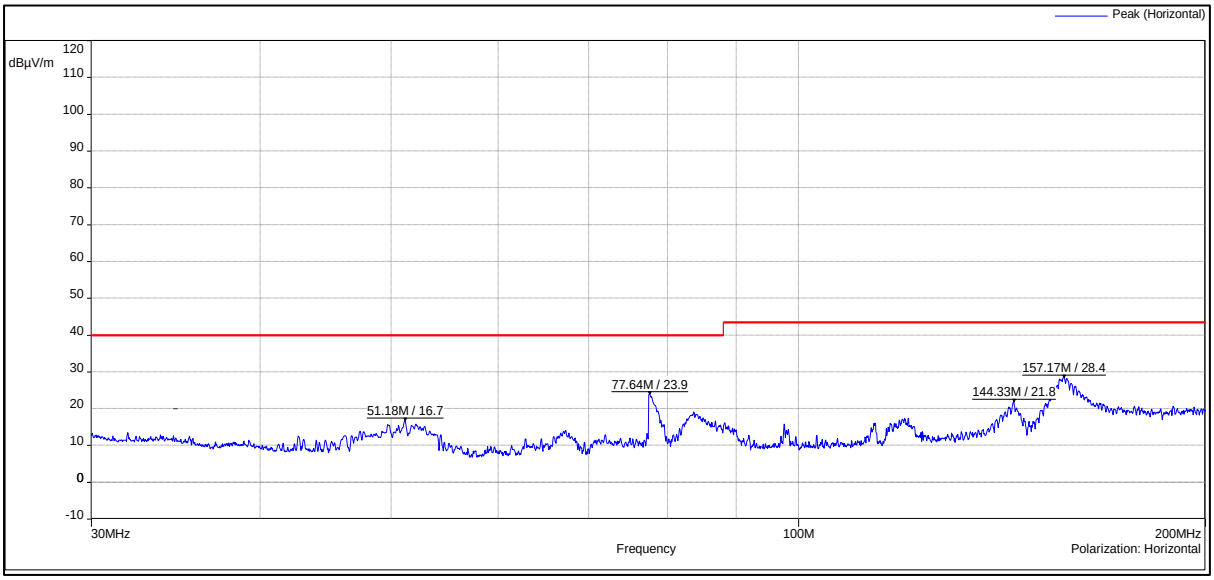
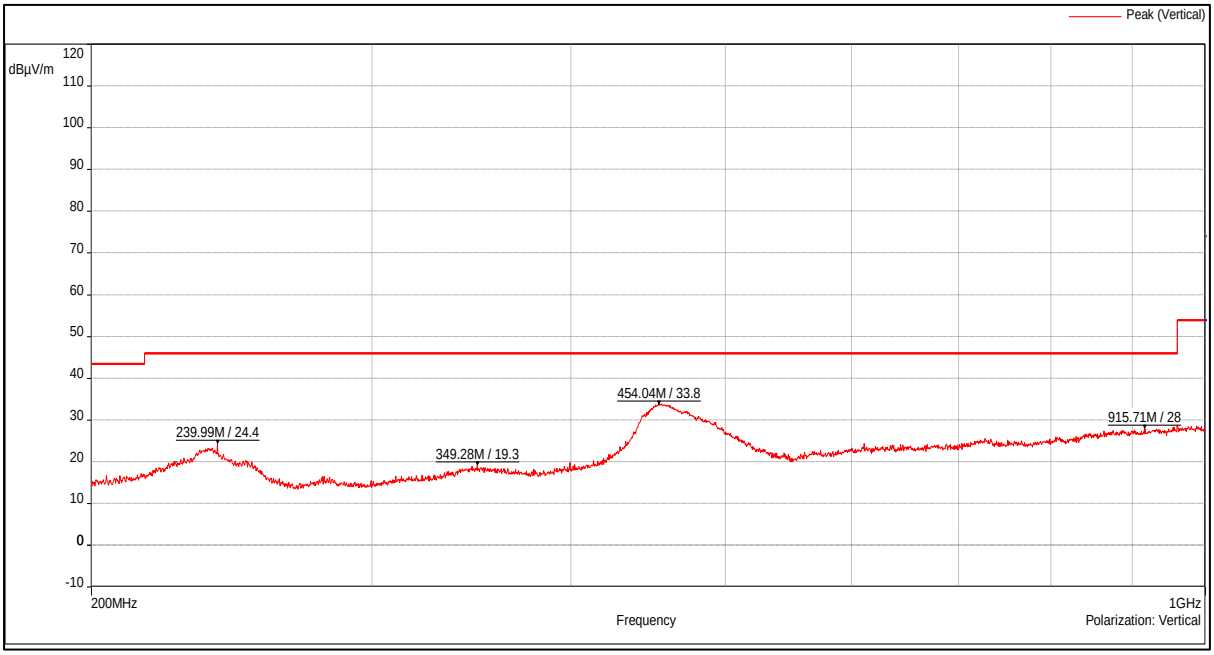
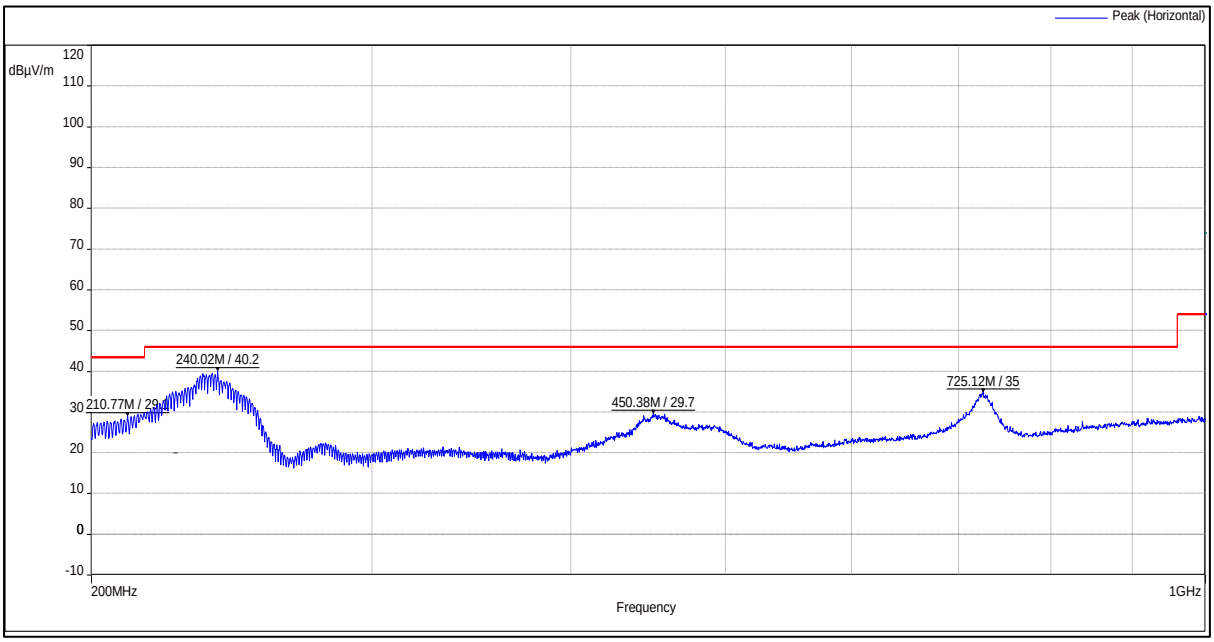


Table 11: Test results for frequency range 200MHz – 1GHz

Antenna Polarization	Measured Frequency (MHz)	Measured emission (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Vertical	239.99	24.40	46.00	-21.60
	349.28	19.30	46.00	-26.70
	454.04	33.80	46.00	-12.20
	915.71	28.00	46.00	-18.00
Horizontal	210.77	29.10	43.50	-14.40
	450.38	29.70	46.00	-16.30
	725.12	35.00	46.00	-11.00

Test Plots:


Peak (Vertical)
dBµV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
239.99M / 24.4
349.28M / 19.3
454.04M / 33.8
915.71M / 28
200MHz
Frequency
1GHz
Polarization: Vertical


Peak (Horizontal)
dBµV/m
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
240.02M / 40.2
210.77M / 29.
450.38M / 29.7
725.12M / 35
200MHz
Frequency
1GHz

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*****End of test report*****